



NASA STTR 2016 Phase I Solicitation

T9.01 Navigation and Hazard Avoidance Sensor Technologies

Lead Center: LaRC

Participating Center(s): JSC

Missions to solar systems bodies must meet increasingly ambitious objectives requiring new or improved capabilities such as: "precision surface-relative navigation", "automatic rendezvous and capture", "well-controlled soft landing", "precision landing", and "hazard avoidance". Robotic missions to the Moon and Mars demand landing at pre-designated sites of high scientific value near hazardous terrain features, such as craters, slopes, and rocks. Missions aimed at paving the path for colonization of the Moon and human landing on Mars need to execute onboard hazard detection and precision maneuvering to ensure safe landing near previously deployed assets. Asteroid missions require precision rendezvous, identification of the landing or sampling site location, and navigation to the highly dynamic object that may be tumbling at a fast rate. NASA seeks sensor technologies enabling these missions to solar system bodies. The same sensor or sensor component technologies can also benefit space operations such as satellite servicing and optical communication.

Sensor and sensor component technologies are sought for providing measurement of vehicle relative proximity and velocity, bearings, and high resolution 3-dimensional images during the approach to the targeted body. Also of interest are sensors capable of measuring atmospheric winds and density for aiding navigation and guidance of landing vehicles in general and large hypersonic decelerators in particular. The proposals should target advanced sensor technologies for eventual space utilization. Phase I research should demonstrate the technical feasibility and show a path toward a Phase II prototype unit. Phase II prototypes should be capable of laboratory demonstration and preferably suitable for operation in the field from an aircraft platform or rocket-power terrestrial test vehicles. The component and sensor system technologies being sought include but limited to the following list:

- Highly sensitive Flash lidar camera including 2-D detector array, associated readout integrated circuit (ROIC), and drive/control electronics. Operational wavelength range 1.06-1.54 micron, the camera shall be capable of providing image frames greater than 60k pixels at 20 Hz with better than 3 cm range precision.
- Very compact and rugged laser transmitter operating in the 1.0 μm – 1.6 μm wavelength range with an output pulse energy of 30 mJ to 60 mJ, pulse width of about 6 nsec, and repetition rate of 20 Hz to 50 Hz suitable for flash lidars. The proposed laser must show path in maturing for operation in space environment.
- Non-mechanical laser beam steering devices capable of 2-axis pointing over +/- 25 degrees angle.
- Novel lightweight transmit and receive optical systems for 3-D flash lidar, Doppler lidar, or laser altimeter with aperture size from 5 cm to 10 cm suitable for operation in space environment.
- Space-qualifiable compact and rugged single-frequency CW laser systems operating at 1.55 micron wavelength region. Proposed lasers must be able to generate at least 5 W of power with less than 5 KHz linewidth over a tunable range of about 50 nm. Systems must be highly wavelength stable and come with full supporting electronic systems for thermal and power control. The lasers must be developed with space environment considerations and demonstrate a clear path to space.

